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(54) **Brake**

(57) A brake for applying brake force especially but not exclusively to a disc in which the shoes (16, 18) are applied by screws. Each screw (50) has a nut (56) and the nuts are rotatable in unison by a lever mechanism (20). The lever mechanism (20) acts on the nuts through pawl and ratchet means (90, 58) for wear take-up.

The lever mechanism (20) sustains the reactions in the direction of shoe-applying movement arising from applying movement of the nuts.

Typically, the brake is applied by springs (24, 26) and released by a powered thrustor (22).

The brake is applicable to the hoists of large cranes such as steelworks ladle cranes.

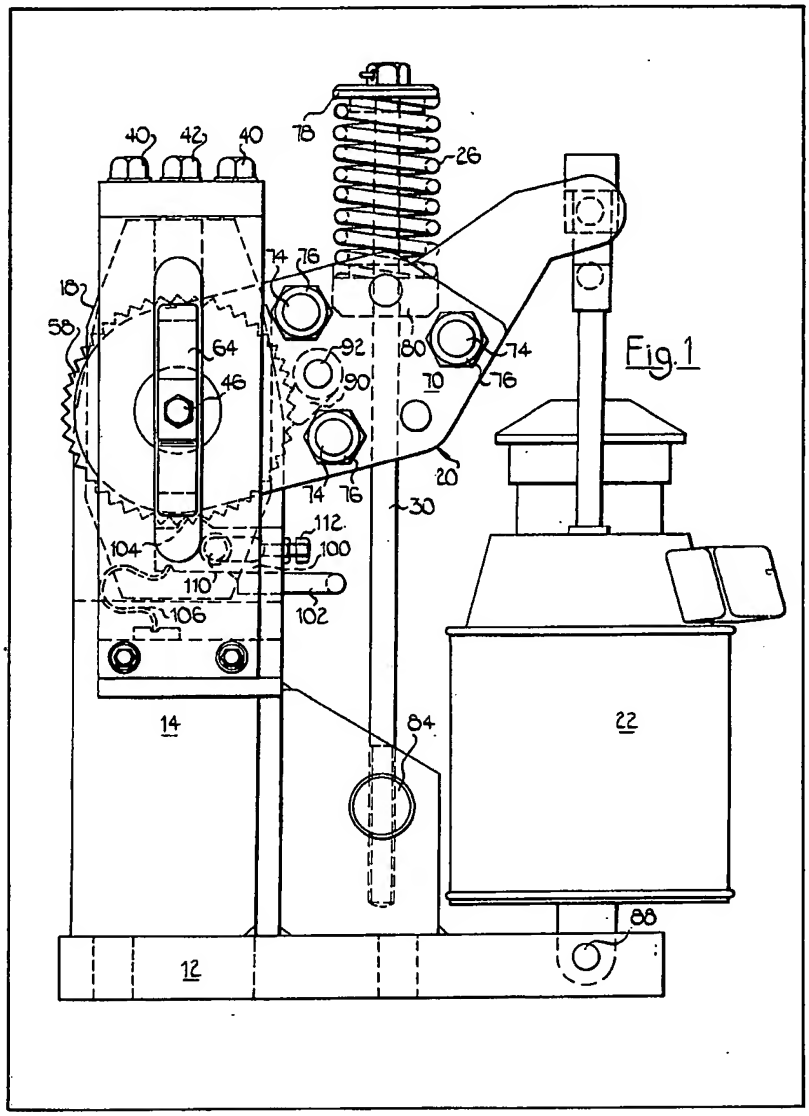

Fig.1

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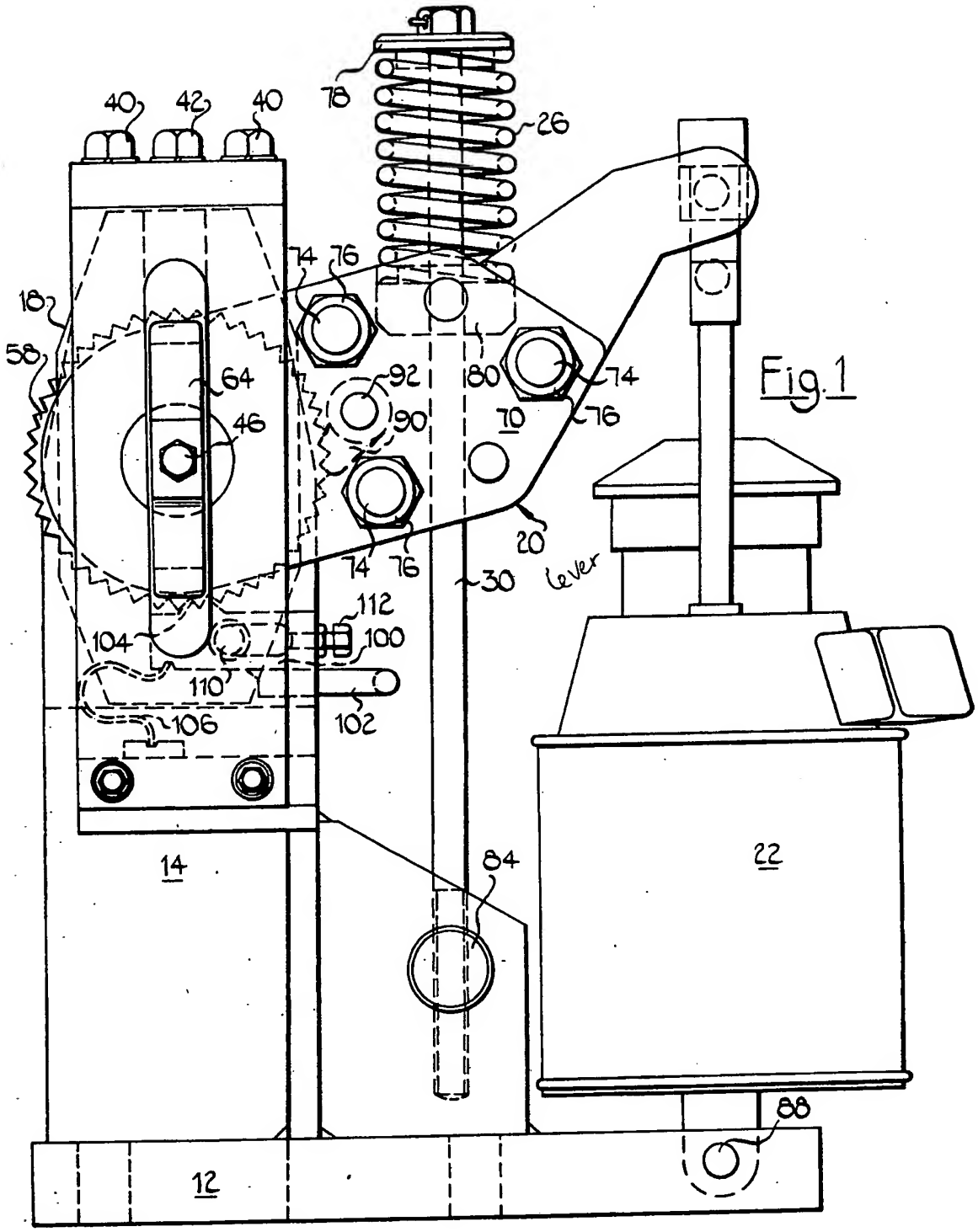

Fig.1

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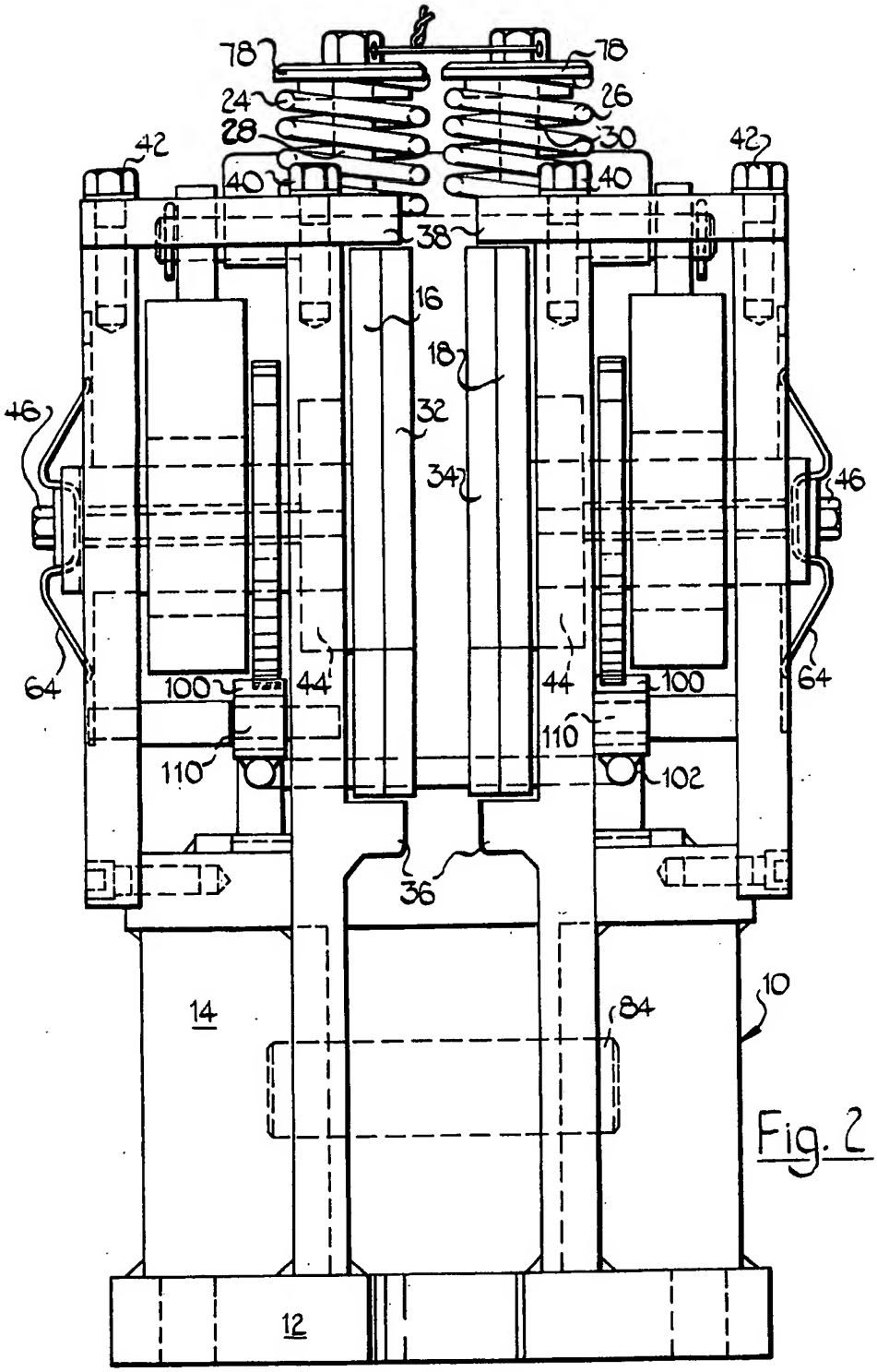

Fig. 2

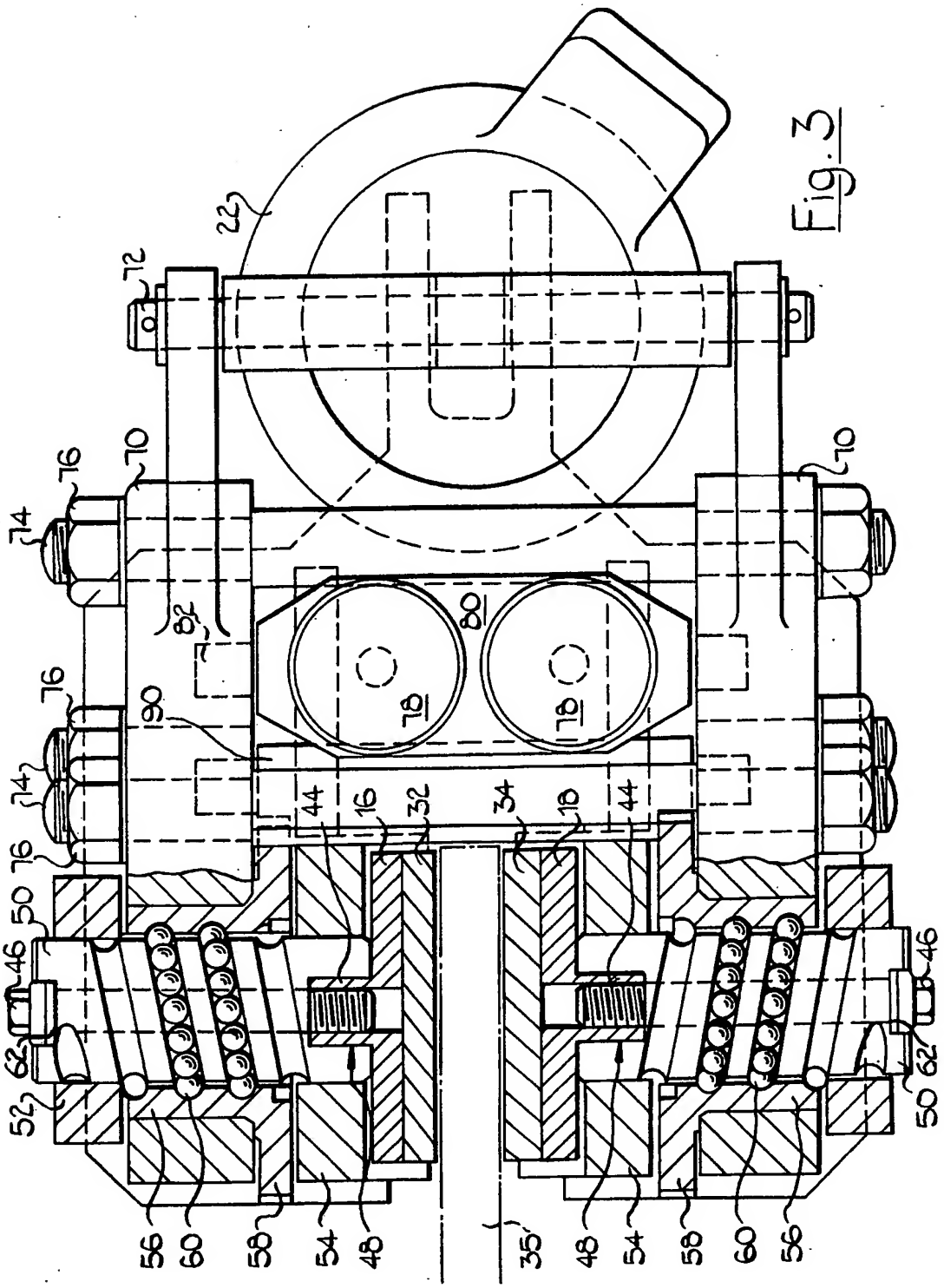
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Fig. 3

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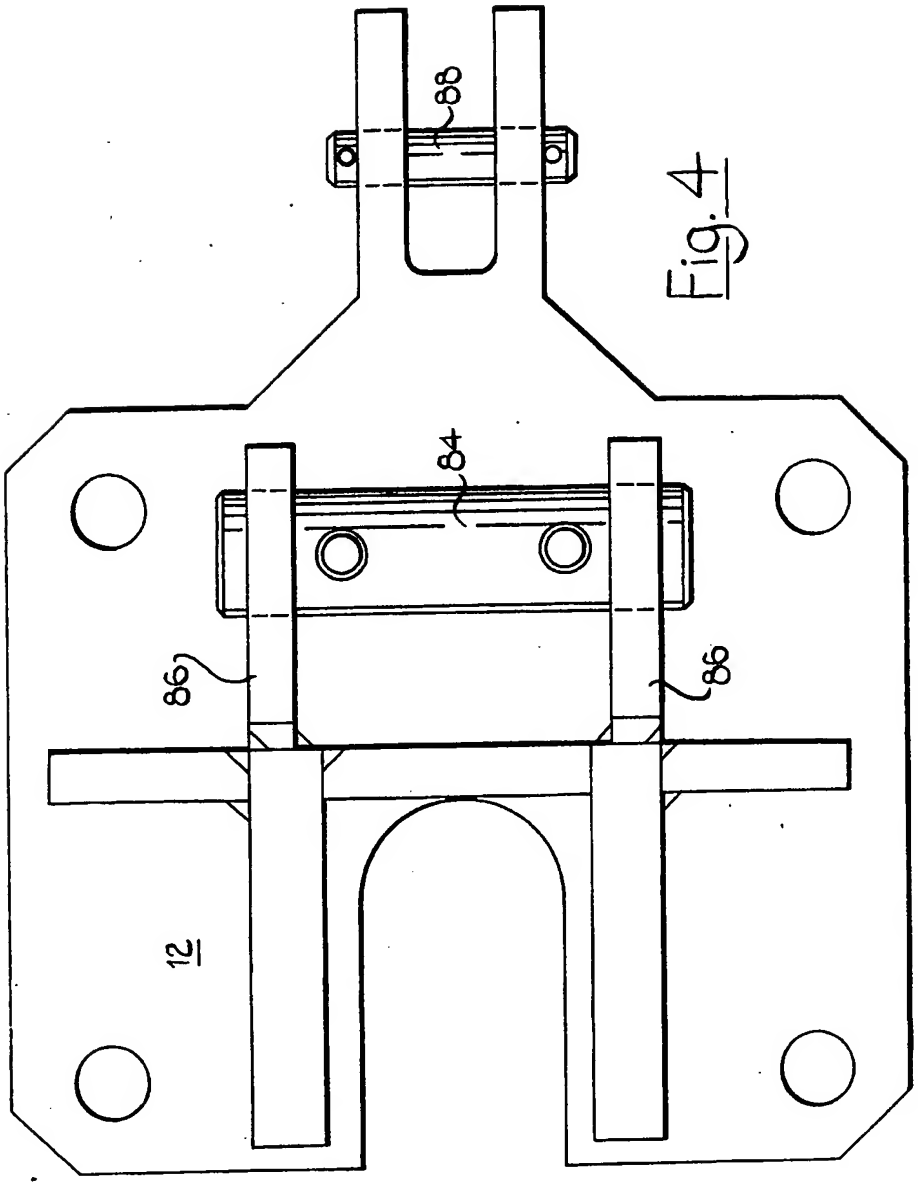

Fig. 4

SPECIFICATION

Brake

The invention relates to brakes.

A brake according to the invention comprises a support carrying two opposed, spaced apart brake shoes, each shoe being capable of brake applying movement towards and of return movement away from the other shoe by endwise movement of a respective screw-member, each screw-member being movable endwise by rotation of a respective nut about the screw and the nuts being rotatable in unison by a lever mechanism acting upon the nuts through respective pawl and ratchet means, and each nut having a respective stop mechanism effective in response to wear of the respective brake shoe to limit return rotation of the nut whereupon return movement of the lever mechanism relative to the nut adjusts the respective pawl relatively to the respective ratchet to compensate for said wear.

Preferably, the two pawls are movable only in unison and the two stop mechanisms are operable only in unison.

Preferably, the shoes and lever mechanism are free to move together parallel to the axes of rotation of the nuts.

Preferably, the lever mechanism is angularly movable about a common axis of rotation of the nuts.

Preferably, the lever mechanism sustains the reaction in the direction of said applying movement of the shoes resulting from rotation of the nuts to produce said movement.

Typically, for example, the lever mechanism is movable in an applying sense by spring means and in the return sense by a powered device such as an electric, hydraulic or pneumatic thruster. It is preferred that the brake also be manually releasable, in that case. In an alternative construction the powered device may be dispensed with and the brake may be manually applied, springs for example being arranged to provide return movement of the shoes. In yet another construction both applying and return movement of the shoes may be manually effected without any springs being employed.

One form of brake will now be described by way of example to illustrate the invention with reference to the accompanying drawings in which:—

Figure 1 is a side-elevation of the brake;

Figure 2 is an end-elevation of the brake shown in Figure 1;

Figure 3 is a plan of the brake shown in Figure 1; and

Figure 4 is a plan of a component of the support of the brake shown in the preceding drawings.

The brake shown in the drawings consists of the following main components: a support 10 including a base 12 and a frame 14; two opposed brake shoes 16, 18; a lever mechanism 20; an electric thrustor 22 mounted on the base 12 and acting on the lever mechanism 20; and brake-applying springs 24, 26 acting between the lever mechanism 20 and respective tie-rods in the form of long screws 28, 30 secured to the support 10.

The brake shoes 16, 18 are in the form of back-plates which have respective brake-linings 32, 34 each vulcanised to the shoe back-plate or which alternatively may be rivetted to the back-plates. The front faces of the linings 32, 34 are opposed to one another and spaced apart to receive between them a brake-disc 35 (Figure 3) mounted on a shaft (not shown) which is to be braked.

The frame 14 has lower horizontal shoulders 36 supporting the brake shoes 16, 18 and has upper horizontal plates 38 trapping the shoes. Shoes may be removed by removing two bolts 40 at each plate 38 and turning the plates through 90° in each case about a bolt 42. Each back-plate has a key 44 which, after bolts 46 have been sufficiently unscrewed to clear the respective key 44, can be slid upwardly out of a corresponding slot 48 in a respective screw 50.

Each screw 50 is located in opposed apertures in opposed components 52, 54 of the frame 14 and extends through a respective nut 56. Each nut 56 has an integral ratchet 58 and is interconnected with the respective screw 50 by balls 60 running in respective helical channels lying between the threads of the nut and screw.

The screws 50 are prevented from rotating by their engagement at their slots 48 with the keys 44 of the shoes 16, 18.

The outer ends of the screws 50 have slots 62 accommodating shoe retraction springs 64 secured to the screw by the bolt 46 in each case, which extends through the screw 50.

The retraction springs also function to eliminate backlash in the screw and nut mechanism; to prevent rotation of the screws when the shoes are removed and replaced, thus ensuring proper orientation of the slots 48; and to prevent screw rotation when the ratchet 58 is rotated without the shoes in position during setting up and re-adjustment procedures.

The lever mechanism 20 consists of two similar, spaced apart lever arms 70 having corresponding ends probably mounted on the nuts 56, and opposite ends spanned by a pivot pin 72 upon which the thrustor 22 acts. The arms 70 are inter-connected by heavy rods 74 secured to the arms by nuts 76. The springs 24, 26 are located between discs 78 retained on the screws 28, 30 by their heads and a block 80 which is pivotally mounted between the arms 70 by a pin 82. The screws 28, 30 are held at their lower screwed ends in tapped holes in a heavy pivot pin 84 carried by lugs 86 of the support 10.

The lower ends of the thrustor 22 is pivotally secured to the base 12 by a pin 88.

The applied brake torque is adjustable by adjustment of the screws 28, 30 which, when screwed into or out of the pin 84 adjust the pre-load in the springs 24, 26.

The lever arms 70 carry between them a double pawl member 90 pivotally mounted on a pin 92 spanning the arms. The pawl member 90 engages both ratchets 58 and is biassed against the ratchets 58 by a spring (not shown).

The frame 14 carries a stop-mechanism in the form of two members 100 which are inter-connected by a bar 102 and which are slidable horizontally on the frame 14. Each member 100 has two teeth 104

forming a short rack which teeth engage the respective ratchet 58 and each member 100 is pressed against the ratchet by a spring 106.

Each member 100 has a horizontal slot 108 through which extends a horizontal stop-pin 110 fixed to the frame 14. Each member 100 carries a horizontal stop-screw 112 having a lock-nut. The end of each stop-screw 112 protrudes into the respective slot 108.

OPERATION:

The drawings show the brake in its fully 'off' condition. The thrustor 22 is energised to hold the lever mechanism 20 in its upper position against the bias of the springs 24, 26. The brake shoes 16, 18 are clear of the brake disc 35 (Figure 3).

To apply the brake the thrustor 22 is de-energised and the springs 24, 26 push the lever mechanism clockwise as seen in Figure 1. The pawl member 90 locks the lever arms 70 to their respective ratchets 58 so that, as the lever mechanism turns, the nuts 56 also turn and force the screws 50 inwardly towards one another and the linings 32, 34 are forced into engagement with the rotating brake disc 35.

The resulting thrusts on the brake shoes parallel to the disc faces are reacted at the shoulders 36 or at the plates 38 of the frame 14 depending on the direction of rotation of the disc 35. The reactions normal to the disc are provided by the U-shaped assembly made up of the arms 70 and the rods 74.

The shoes and the U-shaped assembly can 'float' that is, they can move normally to the disc 35 to equalise the thrusts at the two shoes and equalise wear at the linings 32, 34.

The brake-applying rotation clockwise of the ratchets 58 (Figure 1) moves the stop-members 100 leftward. Successive brake applications cause progressive wear of the linings 32, 34 and on each application the ratchets 58 turn progressively further clockwise in Figure 1 and the members 100 travel progressively further and further to the left in Figure 1. Ultimately, the stop-screw 13 engages the stop-pin 110 and after one or two more brake applications the ratchet 58 in each case moves past the respective member 100 by an amount of one tooth. Then on the return movement of the ratchet 58 the teeth 104 re-engage the ratchet.

The ratchets 58 then return anti-clockwise pushing the members 100 to the right in Figure 1.

The ratchets 58 continue to return until the left-hand ends of the slots 108 engage the stop-pins 110 whereupon the ratchets return movements are halted. The lever mechanism 20 continues its return movement anti-clockwise in Figure 1, the pawl 90 moving past the ratchet 58 in each case to a new position which is one tooth further round the ratchet in its anti-clockwise sense.

On the next application of the brake, the pawls 90 lock the lever arms 70 to the ratchets 58 as before but the ratchets are of course in angular positions which are advanced by one tooth relatively to the lever arms so that the shoes 16, 18 are now adjusted for wear relatively to the lever arms and will be once more fully applied by a relatively small proportion of the maximum travel of the lever arms.

The automatic adjustment for wear just described is effected after the shoes have left the disc 35 so that there are no end thrusts between the rear faces of the ratchets 58 and the inner faces of the arms 70. Friction between those surfaces is therefore at a minimum when adjustment is effected.

The adjustments of the levers relatively to the ratchets are effected in unison and by equal amounts of one tooth in each case, the pawl 90 being common to both ratchets and the two members 100 being connected together.

The brake described above is typically intended for use on hoist or travel motions on overhead travelling cranes. The brake may be applied to a disc or directly to the flange of a hoist barrel if preferred.

For example, in the brake described the clearances between the two linings 32 and 34 from the respective faces of the disc 35 typically total 1±0.25 millimetre (mm).

The thrustor 22 has a stroke of 75 mm of which 40 mm is used when the linings are new. The total thickness of the two linings 32 and 34 is 30 mm out of which 20 mm is considered adequate useful wear.

The automatic adjustment by one tooth described above is effected each time the total clearance between linings and disc reaches 1.25 mm, at which condition the thrustor stroke is 50 mm. The automatic adjustment reduces the total clearance to 0.75 mm.

The brake described by way of example typically exerts 3500 kilograms force parallel to the disc faces. At a nominal operating radius of 375 mm. measured from the shoe centres to the axis of rotation of the disc the brake typically exerts a braking torque of 1300 KgM, the thrustor exerting 132 kg at 75 mm. stroke.

The brake described is relatively compact so that for large ladle cranes, for example, only three sizes of such a brake would be needed to meet the requirements of the range of standard electric motor frame sizes encountered on such cranes, with one larger size of brake being used for emergency braking. In the case of the emergency brake two brakes per hoist barrel would be used and the thrustor would preferably be a pneumatic thrustor. The emergency brakes would be applied directly to the flange of the hoist barrel functioning as the brake 'disc'.

The reactions provided by the shoulders 36 or plates 38 act along lines lying very close to the planes of the friction forces at the disc faces so that negligible consequential moments are produced and vibration and uneven wear arising from such moments are greatly minimised.

The shoulders and plates overlap the linings so that the brake will function even if the linings become detached from the backplates.

The brake can be used to grip an elongate member instead of a disc to effect braking relatively between the member and brake. With modified shoes the brake can be used to grip a rotary member having a cylindrical surface engageable by the shoes.

CLAIMS

1. A brake comprising a support carrying two opposed, spaced apart brake shoes, each show being capable of brake applying movement towards

and of return movement away from the other shoe by endwise movement of a respective screw-member, each screw-member being movable endwise by rotation of a respective nut about the screw and the nuts being rotatable in unison by a lever mechanism acting upon the nuts through pawl and ratchet means, and the nuts having stop mechanism effective in response to wear of the respective brake show to limit return rotation of the nut whereupon return movement of the lever mechanism relative to the nut adjusts the pawl relatively to the ratchet to compensate for said wear.

2. A brake according to claim 1, in which the two pawls are movable only in unison and the two stop mechanisms are operable only in unison.

3. A brake according to claim 1 or claim 2, in which the shoes and lever mechanism are free to move together parallel to the axes of rotation of the nuts.

4. A brake according to any preceding claim, in which the lever mechanism is angularly movable about a common axis of rotation of the nuts.

5. A brake according to any preceding claim, in which the lever mechanism sustains the reaction in the direction of said applying movement of the shoes resulting from rotation of the nuts to produce said movement.

6. A brake according to any preceding claim, in which the lever mechanism is movable in the applying sense by spring means and in the return sense by a powered device.

7. A brake according to any claim of claims 1 to 5, in which the lever mechanism is manually movable in the applying sense.

8. A brake according to claim 7, in which return movement is effected by spring means.

9. A brake according to claim 7, in which return movement is effected manually.

10. A brake substantially as herein described with reference to the accompanying drawings.

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